Geophysical Research Abstracts
Vol. 19, EGU2017-535, 2017
EGU General Assembly 2017

Ultramafic lavas and pyroxene-spinifex high-Mg basaltic dykes from the Othris ophiolite complex, Greece

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This study aims to constrain the physico-chemical conditions and processes associated with the origin of ultramafic lavas of the Agrilia formation and high-Mg basaltic dykes in the Pournari area within the Othris ophiolite complex, a supra-subduction zone ophiolite of Mesozoic age (Paraskevopoulos & Economou, 1986; Barth et al., 2008). Hand-sample-scale spinifex texture is lacking from the ultramafic lavas and, despite whole-rock MgO contents greater than 31 wt.%, we infer an upper bound of 17 wt.% MgO for the erupted liquid, and thus identify these lavas as picrites containing accumulated olivine. We use textural and compositional criteria to divide the crystals within the Agrilia lavas between pre-eruptive and post-eruptive growth phases. The high-Mg basaltic dyke margins display a distinctive thin-section-scale micro-spinifex texture of skeletal and plumose Al- and Fe-rich clinopyroxene surrounded by large crystals of orthopyroxene. Normally zoned clinopyroxene in the Agrilia lavas and clinopyroxene of various textures (skeletal, needle- and dendritic-like) and sizes in the Pournari dykes display anomalous enrichment in Al_2O_3 and FeO* with decreasing MgO that require rapid, disequilibrium growth. Quantitative characteristics of the micro-spinifex pyroxene textures ($<$10 μm in width and 50-100 μm in length) imply a cooling rate for the marginal parts of the Pournari dykes of at least 25 ºK/hr and more likely 45-55 ºK/hr (Faure et al., 2004) and rapid growth of clinopyroxene crystals at a linear rate of about 10^{-6} m/s (Welsch et al., 2016). MELTS models of the crystallization sequence of the Pournari dykes indicate that progressive low-pressure (500 bar) fractional crystallization of the ultramafic dyke liquid occurred under oxidized (QFM+2.0) and hydrous (at least 0.5 wt.% H_2O) conditions. A hydrous magmatic parent for the Othris ophiolite as a whole is further supported by preliminary investigation of melt inclusions (5-20 μm in diameter) in fresh chromite from Agrilia samples that reveals the presence of Na, K, S, Cl, and F in microcrystalline aggregates of rhönite, clinopyroxene, amphibole, apatite, serpentine and chlorite. Ratios of Platinum Group Elements and related metals are Pd/Ir=11.5-13.0, Cu/Pd=6000-7210, Ti/Pd=22.78-31.97$\times 10^3$ for Agrilia lavas and Pd/Ir=4.5-14.0, Cu/Pd=3140-5550, Ti/Pd=4.66-17.32$\times 10^3$ for Pournari dykes; all are very close to those reported for typical komatiites (Barnes et al., 1988). Despite the absence of true komatiite lavas, a number of geochemical features of the Othris suite, including the PGE contents and ratios and the micro-spinifex, disequilibrium cpx growth, are similar to Mesozoic and Archaean komatiites.

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